

FORM PTO-1390
(REV. 11-2000)

US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

A91088

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. § 371**

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/868425

INTERNATIONAL APPLICATION NO. ☐
PCT/EP99/09634

INTERNATIONAL FILING DATE
12/08/1999

PRIORITY DATE CLAIMED
12/15/1998

TITLE OF INVENTION MODULE FILTER COMPRISING AT LEAST ONE ADMISSION FOR THE NON-FILTRATE AND AT LEAST ONE DISCHARGE FOR THE FILTRATE AND COMPRISING AT LEAST ONE FILTER MODULE

APPLICANT(S) FOR DO/EO/US

Wolfgang Diemer, Horst Freischlag, Klaus Figgie, Eberhard Scheible

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

- 1 ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. § 371 ☐
- 2 ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. § 371 ☐
- 3 ☒ This is an express request to begin national examination procedures (35 U.S.C. § 371(f)) ☐ The submission must include items (5), (6), (9) and (21) indicated below ☐
- 4 ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31) ☐
- 5 ☒ A copy of the International Application as filed (35 U.S.C. § 371(c)(2)) ☐
 - a ☐ is attached hereto (required only if not communicated by the International Bureau) ☐
 - b ☒ has been communicated by the International Bureau ☐
 - c ☐ is not required, as the application was filed in the United States Receiving Office (RO/US) ☐
- 6 ☒ An English language translation of the International Application as filed (35 U.S.C. § 371(c)(2)) ☐
 - a ☒ is attached hereto ☐
 - b ☐ has been previously submitted under 35 U.S.C. § 154(d)(4) ☐
- 7 ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. § 371(c)(3)) ☐
 - a ☐ are attached hereto (required only if not communicated by the International Bureau) ☐
 - b ☐ have been communicated by the International Bureau ☐
 - c ☐ have not been made; however, the time limit for making such amendments has NOT expired ☐
 - d ☐ have not been made and will not be made ☐
- 8 ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. § 371(c)(3)) ☐
- 9 ☒ An oath or declaration of the inventor(s) (35 U.S.C. § 371(c)(4)) ☐
- 10 ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. § 371(c)(5)) ☐

Items 11 to 20 below concern document(s) or information included:

- 11 ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98 ☐
- 12 ☒ An assignment document for recording ☐ A separate cover sheet in compliance with 37 CFR 3.128 and 3.131 is included ☐
- 13 ☒ A **FIRST** preliminary amendment ☐
- 14 ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment ☐
- 15 ☐ A substitute specification ☐
- 16 ☐ A change of power of attorney and/or address letter ☐
- 17 ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter2 and 35 U.S.C. § 1821 - 1.825 ☐
- 18 ☐ A second copy of the published international application under 35 U.S.C. § 154(d)(4) ☐
- 19 ☐ A second copy of the English language translation of the international application under 35 U.S.C. § 154(d)(4) ☐
- 20 ☒ Other items or information:
Application Data Sheet

"Express Mail" Label # EF 419 678 506 US - I hereby certify that this paper or fee is being deposited with the USPS "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on 06/15/2001, and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Gudrun E. Hockett, Patent Agent

U.S. APPLICATION NO. (if known, see 37 CFR 1.53) **09/868425**

INTERNATIONAL APPLICATION NO.
PCT/EP99/09634

ATTORNEY'S DOCKET NUMBER
A91088

21 ☒ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **\$1000.00**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **\$860.00**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **\$710.00**

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **\$690.00**

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **\$100.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =

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\$ 860.00

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e))

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$
Total claims	24 - 20 =	4	x \$18.00	\$ 72.00
Independent claims	1 - 3 =	0	x \$80.00	\$ 0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ \$270.00
TOTAL OF ABOVE CALCULATIONS =				\$ 932.00
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				+
SUBTOTAL =				\$
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f))				\$
TOTAL NATIONAL FEE =				\$ 932.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property.				+ \$ 40.00
TOTAL FEES ENCLOSED =				\$ 972.00
				Amount to be refunded: \$
				charged: \$

a. ☒ A check in the amount of \$ 972.00 to cover the above fees is enclosed. (check # 1232)

b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-1199. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.437 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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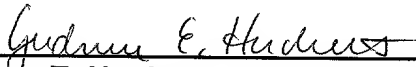
Gudrun E. Hockett
SIGNATURE

Gudrun E. Hockett

NAME 35,747

REGISTRATION NUMBER

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**"Express Mail" Mailing Label Number EF 419 678 506 US****Date of Deposit June 15, 2001****I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.**


Gudrun E. Hockett, Patent Agent

Applicant: Wolfgang Diemer, et al.
Serial No: not yet known (based on PCT/EP99/09634)
International Filing Date: 12/8/1999
U.S. Filed: 6/15/2001
For: Module Filter Comprising at least One Admission for the
Non-Filtrate and at least One Discharge for the Filtrate and
Comprising at Least One Filter Module

Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Prior to the first office action, please amend the instant application as follows:

IN THE SPECIFICATION:

Please substitute pages 1, 3, and 4 on file with the attached clean copies of the amended pages 1, 3, and 4. A marked-up version of the pages 1, 3 and 4 with all the changes shown is also attached.

IN THE CLAIMS:

Claims 1 through 20 are cancelled.

Please add the attached new claims 21-44 to the specification.

IN THE ABSTRACT:

Please add the attached Abstract of the Disclosure to the specification.

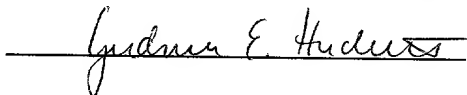
REMARKS

Claims 1-20 have been cancelled and replaced with claims 21-44 drafted in proper U.S. format. Proper headings according to the guidelines for drafting a nonprovisional patent application under 35 U.S.C. 111(a) have been added. A proper Abstract of the Disclosure has been added to the specification.

In view of the foregoing, it is submitted that this application is now in condition for allowance and such allowance is respectfully solicited.

Authorization is herewith given to charge any fees or any shortages in any fees required during prosecution of this application and not paid by other means to Patent and Trademark Office deposit account 50-1199.

Respectfully submitted on June 15, 2001



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GEH

Encl.: new claims 21-44; pages 1, 3, and 4 (clean copies; marked-up version); Abstract

NEW CLAIMS 21-44

21. A module filter (1) comprising:

a container (2), comprised of at least one container housing (3) and a container bottom (4) and comprising at least one admission (6') for a non-filtrate (6) and a discharge for the filtrate (7);

at least one filter module (8) arranged in said container housing (3) and comprised of several stacked, disc-shaped filter cells (9) substantially comprised of filter material (40) and having an inner space (24), wherein said filter cells (9) have a central opening (10), respectively, wherein said central openings (10) form at least one central channel (28) connected in fluid communication with said inner space (24) of said filter cells (9);

said central channel (28) connected to said admission (6') for the non-filtrate;

said container housing (3) having a space (3') surrounding said filter cells (9), wherein said space (3') is connected with said discharge (7') for the filtrate;

circular disc-shaped drainage support bodies (17) arranged between said filter cells (9), wherein said drainage support bodies (17) extend at least approximately over the entire surface area of said filter cells (9);

said drainage support bodies (17) having a plurality of drainage channels (35), respectively, wherein said drainage channels (35) extend toward an outer rim of said drainage support bodies (17);

said drainage support bodies (17) having projections (31, 32) projecting

axially away from said drainage support bodies (17) and extending in a radial direction of said drainage support bodies (17), respectively;

wherein between said projections (31, 32) intermediate spaces are defined;

and

wherein said intermediate spaces form said drainage channels (35) and are configured to remove the filtrate.

22. The module filter according to claim 21, wherein said filter cells (9) and said drainage support bodies (17) have a descending slope extending from said central channel (28) radially outwardly.

23. The module filter according to claim 21, wherein said drainage support bodies (17) and said filter cells (9) are formed as circular disks and have at least substantially the same diameter.

24. The module filter according to claim 23, wherein said drainage channels (35) extend in the form of radial beams to a peripheral rim of said drainage support body (17).

25. The module filter according to claim 21, wherein on a side of each one of said filter cells (9) facing said central channel (28) a support element (41) is provided, wherein said support elements (41) are positioned such that said filter material (40) of each one of said filter cells (9) is spaced apart by said support elements (41), respectively, wherein said support element (41) is a support ring having a penetration (44), wherein said penetration (44) provides a fluid communication from said central channel (28) to said inner space (24) of said filter cells (9), respectively.

26 The module filter according to claim 25, wherein said support ring (41) has

an inner diameter (D) matching approximately the diameter of said central opening (10).

27. The module filter according to claim 25, wherein said support ring (41) is comprised of a flat annular base body (42), wherein said base body (42) has spaced apart axial projections (43) extending radially strip-shaped on both sides of said base body (42).

28. The module filter according to claim 1, wherein each one of said filter cells (9) is comprised of an upper layer (9.1) and a lower layer (9.2) of said filter material (40) and a frame (29), wherein radially outer rims (51) of said upper and lower layers (9.1, 9.2) are connected by said frame (29) to one another.

29. The module filter according to claim 28, wherein said filter material (40) is a nonwoven filter cloth.

30. The module filter according to claim 28, wherein each one of said frames (29) comprises an underside with support knobs (30) and said frames (29) are supported on one another by said support knobs (30).

31. The module filter according to claim 21, further comprising a closure ring (11) arranged axially at the ends of said filter module (8), respectively, and coaxially to said central opening (10), wherein said filter module (8) is comprised of several of said filter cells (9) and several of said drainage support bodies (17) alternately stacked on one another.

32. The module filter according to claim 31, further comprising a securing element (23) configured to secure said alternately stacked filter cells (9) and drainage support bodies (17) and to receive tensile forces, wherein said securing element (23) is arranged at a side of said alternately stacked filter cells (9) and drainage support bodies

(17) facing said central channel (28).

33. The module filter according to claim 32, wherein said securing element (23) is a sleeve (23) comprised of metal and having a mantle surface provided with a plurality of openings (39), wherein said sleeve (23) has end faces and is connected with said end faces positive-lockingly with said closure rings (11).

34. The module filter according to claim 33, wherein said closure ring (11) has a recess in the form of an annular ring (26) configured to receive a sealing ring (19).

35. The module filter according to claim 21, further comprising:
a central tie rod (33) arranged in said central channel (28);
a fastening arrangement (25), wherein said central tie rod (33) is supported by said fastening arrangement (15) on said container bottom (4); and
a drainage cover plate (34) arranged at an upper end of said central tie rod (33).

36. The module filter according to claim 35, wherein said container (2) has a container cover (36) and wherein said drainage cover plate (34) is supported by a support cap (12) with support ribs (13) on said container cover (36).

37. The module filter according to claim 35, wherein said drainage cover plate (34) is a press plate (14) provided with an axial tie rod.

38. The module filter according to claim 35, wherein several of said filter modules (8) are aligned with said central openings (10) axially above one another and are secured by said drainage cover plate (34) in said container (2).

39. The module filter according to claim 38, wherein said container (2) has a

container cover (36) and wherein said drainage cover plate (34) is supported by a support cap (12) with support ribs (13) on said container cover (36).

40. The module filter according to claim 38, wherein said drainage cover plate (34) is a press plate (14) provided with an axial tie rod.

41. The module filter according to claim 38, further comprising a drainage bottom plate (46) arranged between said container bottom (4) and a lowermost one of said filter modules (8), wherein said drainage bottom plate (46) has a recess (47) in an area neighboring said discharge (7').

42. The module filter according to claim 38, further comprising a pressing device (49) configured to secure said filter modules (8) between said drainage cover plate (34) and said drainage bottom plate (46).

43. The module filter according to claim 42, wherein said container (2) has a container cover (36) and wherein said pressing device (49) is supported external to said container (2) on said container cover (36).

44. The module filter according to claim 42, wherein said pressing device (49) is supported inside said container (2) on said container bottom (4) by said central rod (33) and said fastening arrangement (15).

CLEAN COPY OF PAGE 1

**MODULE FILTER COMPRISING AT LEAST ONE ADMISSION FOR THE
NON-FILTRATE AND AT LEAST ONE DISCHARGE FOR THE FILTRATE AND
COMPRISING AT LEAST ONE FILTER MODULE**

Background of the Invention

The invention relates to a module filter with at least one admission for the non-filtrate and a discharge for the filtrate and with at least one filter module.

From EP 0 233 999 A a filter module is known in which the filter cells and support bodies are stacked alternately along a central pipe. Support structures are also provided in the filter cells which support the filter material of the filter cells. The non-filtrate is guided from the exterior into the filter cells, and the filtrate is discharged via the interior of the filter cells and via the central pipe. A disadvantage in this connection is that, on the one hand, the support bodies prevent a uniform entry of the non-filtrate into the filter cells and, on the other hand, the filtered materials deposit on the support bodies between the filter cells and on the entire interior chamber of the module filter.

Summary of the Invention

The present invention has the object to provide a module filter of the aforementioned kind which, with minimized apparatus expenditure, enables a complete separation of the filtrate from the non-filtrate, wherein the separated solids can be disposed of completely and residue-free without necessitating cleaning of the module filter.

This object is solved by a module filter wherein that the central channel is connected to an admission for the non-filtrate and connected with the inner space of the filter cells and in

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that a space surrounding the filter cells is formed within the container housing which is connected with the discharge for the filtrate, and in that the support bodies are formed as drainage support bodies which extend at least approximately over the entire surface area of the filter cells, wherein in the drainage support body a plurality of drainage channels are provided which extend toward the outer rim of the filter cells or the drainage support bodies.

The important advantages of the subject matter of the invention are to be seen in that the inflow of the non-filtrate into the filter module is realized via a central

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The complete filter apparatus is of a very simple configuration and requires minimal investment costs even in connection with high corrosion requirements. The filter modules are connected according to the principle of the prior patent application 197 44 574.8, i.e., by adaptors, which engage the connecting rings of the filter modules. In another embodiment, a central rod takes over several tasks. It serves, on the one hand, for fixing the filter modules stacked in the filter container in that it is guided through their central openings. Moreover, it serves as a tie rod for a lid with press plate at the upper end of the filter module layer in that it is supported by means of a fastening arrangement, in particular, a bayonet closure, on the bottom plate of the module filter. With cooperation of the sealing rings positioned between the filter modules, the filter modules are sealed relative to one another. In another embodiment, a sealing element for sealing relative to the container bottom and the container cover is eliminated because the filter material at these connecting locations is already shaped to have a sealing profile which matches correspondingly profiled surfaces on the container bottom and the container cover. However, the central rod serves particularly as an admission for the non-filtrate which can reach the filter cells via openings in its mantle surface. Usually, a container is placed about the stacked filter modules which, in turn, can be of a light construction because, viewed in the direction of the fluid flow, it is positioned at the almost pressure-free discharge side. The container has only a guiding and shielding function relative to the filtrate flow. When using a central rod, the filter modules are stripped of the central rod and disposed of for removal of the solids. Otherwise, the filter modules are individually decoupled and disposed of.

Brief Description of the Drawings

Embodiments of the invention will be explained in the following in more detail with the aid of the drawing. In the drawing it is shown in:

Fig. 1 the schematic illustration of an axial section of a module filter;

CLEAN COPY OF PAGE 4

- Fig. 2 a cross-section of a filter module according to the Invention;
- Fig. 3 a detail of a plan view onto a drainage support body;
- Fig. 4 a section along the line IV-IV of Fig. 3;
- Fig. 5 a plan view onto a support ring;
- Fig. 6 a cross-section of a support ring;
- Fig. 7 a view VII onto a support ring;
- Fig. 8 a cross-section of a filter module secured at the container cover and container bottom in the embodiment without module seal;
- Fig. 9 a detail with two variants of pressing devices for the drainage cover plate.

Description of Preferred Embodiments

In Fig. 1, a module filter 1 for the filtration of liquids, such as chemical suspensions or wine, beer and juice, is illustrated. It is comprised of the container 2 with housing 3 and bottom 4. The housing 3 is secured by means of mushroom head anchor screws 5 in a pressure-tight way on the bottom 4. In the container a central rod 33 is secured on the bottom 4 by means of a fastening arrangement 15 which is formed, in particular, as a bayonet closure.

The filter modules 8 are arranged with their central openings 10 axially aligned on top of one another and form a central channel 28 at their center. The filter modules 8 are sealed relative to one another by sealing rings 19 and by a drainage cover plate 34 which is supported either by means of a support cap 12 with support ribs

MARKED-UP VERSION OF PAGE 1

MODULE FILTER COMPRISING AT LEAST ONE ADMISSION FOR THE
NON-FILTRATE AND AT LEAST ONE DISCHARGE FOR THE FILTRATE AND
COMPRISING AT LEAST ONE FILTER MODULE

Background of the Invention

The invention relates to a module filter with at least one admission for the non-filtrate and a discharge for the filtrate and with at least one filter module ~~of the kind defined in the preamble of claim 1.~~

From EP 0 233 999 A a filter module is known in which the filter cells and support bodies are stacked alternately along a central pipe. Support structures are also provided in the filter cells which support the filter material of the filter cells. The non-filtrate is guided from the exterior into the filter cells, and the filtrate is discharged via the interior of the filter cells and via the central pipe. A disadvantage in this connection is that, on the one hand, the support bodies prevent a uniform entry of the non-filtrate into the filter cells and, on the other hand, the filtered materials deposit on the support bodies between the filter cells and on the entire interior chamber of the module filter.

Summary of the Invention

The present invention has the object to provide a module filter of the aforementioned kind ~~defined in the preamble of claim 1~~ which, with minimized apparatus expenditure, enables a complete separation of the filtrate from the non-filtrate, wherein the separated solids can be disposed of completely and residue-free without necessitating cleaning of the module filter.

This object is solved by a module filter ~~with the features of claim 1~~ wherein that the central channel is connected to an admission for the non-filtrate and connected with the inner

MARKED-UP VERSION OF PAGE 1 - continued

space of the filter cells and in that a space surrounding the filter cells is formed within the container housing which is connected with the discharge for the filtrate, and in that the support bodies are formed as drainage support bodies which extend at least approximately over the entire surface area of the filter cells, wherein in the drainage support body a plurality of drainage channels are provided which extend toward the outer rim of the filter cells or the drainage support bodies.

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- Fig. 7 a view VII onto a support ring;
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Abstract of the Disclosure

A module filter has a container with an admission for a non-filtrate and a discharge for the filtrate. A filter module is arranged in the container and has several stacked, disc-shaped filter cells of filter material having an inner space. The filter cells have central openings forming a central channel connected with the inner space. The central channel is connected to the admission. The container has a space surrounding the filter cells and connected with the filtrate discharge. Circular disc-shaped drainage support bodies are arranged between the filter cells and extend approximately over the entire surface area of the filter cells. The drainage support bodies have drainage channels that extend toward their outer rim. The drainage support bodies have projections projecting axially away from the drainage support bodies and extending radially. Between the projections intermediate spaces are defined which form the drainage channels and remove the filtrate.

6/PR15

09/868425

JC03 Rec'd PCT/PTC 15 JUN 2001

MODULE FILTER COMPRISING AT LEAST ONE ADMISSION FOR THE
NON-FILTRATE AND AT LEAST ONE DISCHARGE FOR THE FILTRATE AND
COMPRISING AT LEAST ONE FILTER MODULE

The invention relates to a module filter with at least one admission for the non-filtrate and a discharge for the filtrate and with at least one filter module of the kind defined in the preamble of claim 1.

From EP 0 233 999 A a filter module is known in which the filter cells and support bodies are stacked alternately along a central pipe. Support structures are also provided in the filter cells which support the filter material of the filter cells. The non-filtrate is guided from the exterior into the filter cells, and the filtrate is discharged via the interior of the filter cells and via the central pipe. A disadvantage in this connection is that, on the one hand, the support bodies prevent a uniform entry of the non-filtrate into the filter cells and, on the other hand, the filtered materials deposit on the support bodies between the filter cells and on the entire interior chamber of the module filter.

The present invention has the object to provide a module filter of the kind defined in the preamble of claim 1 which, with minimized apparatus expenditure, enables a complete separation of the filtrate from the non-filtrate, wherein the separated solids can be disposed of completely and residue-free without necessitating cleaning of the module filter.

This object is solved by a module filter with the features of claim 1.

The important advantages of the subject matter of the invention are to be seen in that the inflow of the non-filtrate into the filter module is realized via a central

channel so that the solids can be deposited in the individual filter cells and cannot exit to the exterior during disposal. Moreover, the danger of washing out filtered material from the filter layers is prevented as a result of the configuration of the module with inwardly arranged inflow. Between the filter cells of the filter module, a drainage support body, respectively, supports the differential pressure and takes over removal of the filtrate to a discharge of the module filter. The drainage support body arranged external to the filter cell also takes over the protective function for the filter layer. Conventionally used protective nonwoven cloth can thus be omitted. It is not necessarily required to provide in the filter cell itself a drainage support body so that the complete interior chamber of the filter cell can be filled with solids. On the one hand, cake washing in the filtration device is thus possible and, on the other hand, the separated solids can be disposed of completely and residue-free by exchanging the filter modules without requiring cleaning of the filter housing surfaces. The operating personnel is thus not endangered during disposal of the solids because the solids together with the filter modules can be removed from the module filter and disposed of.

Also, as a result of the reversed fluid flow, i.e., from the interior of the filter cells to the interior of the container, in comparison to the module filter of the aforementioned kind, the components are only wetted with filtrate. Accordingly, the liquid, which sometimes represents a valuable substance, can be completely recovered at the same time. The cleaning expenditure is eliminated.

In the back washing configuration of the module, a drainage support body which is arranged in the filter cell ensures that a back washing of the filtrate is possible at full operating pressure without the filter cell collapsing. In this connection, a back washing of the filtrate enables a better use of the filter material. Also, a chemical washing of the cake in both directions is possible.

The complete filter apparatus is of a very simple configuration and requires minimal investment costs even in connection with high corrosion requirements. The filter modules are connected according to the principle of the prior patent application 197 44 574.8, i.e., by adaptors, which engage the connecting rings of the filter modules. In another embodiment, a central rod takes over several tasks. It serves, on the one hand, for fixing the filter modules stacked in the filter container in that it is guided through their central openings. Moreover, it serves as a tie rod for a lid with press plate at the upper end of the filter module layer in that it is supported by means of a fastening arrangement, in particular, a bayonet closure, on the bottom plate of the module filter. With cooperation of the sealing rings positioned between the filter modules, the filter modules are sealed relative to one another. In another embodiment, a sealing element for sealing relative to the container bottom and the container cover is eliminated because the filter material at these connecting locations is already shaped to have a sealing profile which matches correspondingly profiled surfaces on the container bottom and the container cover. However, the central rod serves particularly as an admission for the non-filtrate which can reach the filter cells via openings in its mantle surface. Usually, a container is placed about the stacked filter modules which, in turn, can be of a light construction because, viewed in the direction of the fluid flow, it is positioned at the almost pressure-free discharge side. The container has only a guiding and shielding function relative to the filtrate flow. When using a central rod, the filter modules are stripped of the central rod and disposed of for removal of the solids. Otherwise, the filter modules are individually decoupled and disposed of.

Embodiments of the invention will be explained in the following in more detail with the aid of the drawing. In the drawing it is shown in:

Fig. 1 the schematic illustration of an axial section of a module filter;

Fig. 2 a cross-section of a filter module according to the invention;

Fig. 3 a detail of a plan view onto a drainage support body;

Fig. 4 a section along the line IV-IV of Fig. 3;

Fig. 5 a plan view onto a support ring;

Fig. 6 a cross-section of a support ring;

Fig. 7 a view VII onto a support ring;

Fig. 8 a cross-section of a filter module secured at the container cover and container bottom in the embodiment without module seal;

Fig. 9 a detail with two variants of pressing devices for the drainage cover plate.

In Fig. 1, a module filter 1 for the filtration of liquids, such as chemical suspensions or wine, beer and juice, is illustrated. It is comprised of the container 2 with housing 3 and bottom 4. The housing 3 is secured by means of mushroom head anchor screws 5 in a pressure-tight way on the bottom 4. In the container a central rod 33 is secured on the bottom 4 by means of a fastening arrangement 15 which is formed, in particular, as a bayonet closure.

The filter modules 8 are arranged with their central openings 10 axially aligned on top of one another and form a central channel 28 at their center. The filter modules 8 are sealed relative to one another by sealing rings 19 and by a drainage cover plate 34 which is supported either by means of a support cap 12 with support ribs

13 against a container cover 36 or by a press plate with tie rod 14 against the bottom 4 so that the filter modules 8 are secured between a drainage bottom plate 46 and a drainage cover plate 34. The drainage cover plate according to a further embodiment of the module filter can be pressed by a pressing device, which is supported on the container cover external to the container. Between the individual filter modules 8 drainage intermediate plates 18 are positioned which guide the filtrate away between the filter modules 8 and support the differential pressure between the filter modules 8. Each filter module 8 is comprised of several stacked filter cells 9.

A connecting pipe 6 on the container bottom 4 serves as an admission 6' for the non-filtrate which reaches the interior of the filter cells 9 via the central channel 28 and openings 39 arranged in its mantle surface 38. The solids are deposited here and the filtrate enters the hollow space delimited by the housing 3 through the intermediate spaces of the neighboring filter cells 9. The filtrate flows to the container bottom 4 and exits from the hollow space 3' surrounding the filter modules 8 through the discharge 7' into a connecting pipe 7 for discharging the filtrate. In the area of the discharge 7', the drainage bottom plate 46 has a recess 47 so that there is always a sufficient cross-sectional space available for the filtrate.

Fig. 2 shows a cross-section of one half of the filter module 8 which is comprised of several disc-shaped filter cells 9 which are stacked on one another with interposition of a drainage support body 17, respectively. The filter cells 9 have a central opening 10 and are aligned such that they are congruently positioned above one another. The filter cells 9 are comprised substantially of two layers 9.1 and 9.2 of a filter material, in particular, a filter layer and/or a filter membrane wherein the radially outer edges of the upper and lower layers are connected sealingly by a peripheral frame 29. Between the layers 9.1 and 9.2 of the filter cells 9 a hollow

space 24 is formed. At the underside of the frame 29, support knobs 30 are uniformly distributed about the periphery wherein each filter cell 9 is supported by means of the support knobs 30 on the frame 29 of the neighboring filter cell 9 so that a predetermined spacing between two neighboring filter cells 9 is maintained.

In order to keep the respective hollow space 24 of the filter cells 9 in open communication with the central channel 28, ring-shaped support elements 41 are inserted whose inner radius is matched to the cross-sectional shape of the central channel 28. As can be seen in the plan view of Fig. 5 and an enlarged illustration of a view in the radial direction according to Fig. 7, the support elements 41 are formed of a central disc 42 with axially projecting and radially oriented ribs 43. The filter cells 9 are provided at the radially inwardly positioned area with cover rings 27 of a pressure-proof material on which the ribs 43 of the support elements 41 are supported.

Between the filter cells 9 drainage support bodies 17 are inserted which have a contour substantially identical with that of the filter cells 9. The drainage support bodies 17 are secured by projections 22 in that these penetrate into the substantially softer material of the upper and lower layers 9.1 and 9.2 of the neighboring filter cells 9. At the axial ends of the filter modules 8, a closure ring 11 is provided, respectively, which rests against the outer side of the filter cells 9 positioned at the end and which has an annular groove 26 in the end face facing away from the filter module 8. A sleeve 23 extends through the central openings of all filter cells 9 wherein the sleeve is provided with a plurality of openings 39 in its mantle surface so that the hollow spaces 24 of the filter cells 9 are connected with the central channel 28 extending within the sleeve 23.

The sleeve 23 has at its axial ends a bent edge 25 with a portion extending in the

axial direction to the filter module 9 and engaging the annular groove 26 to thus secure the filter module 8 comprised of the filter cells 9, the drainage support bodies 17, and the support elements 41 in its position. Moreover, in the annular groove 26 a sealing ring 19 is provided which has in a preferred embodiment sealing lips 20, 20'; 21, 21' facing toward and away from the filter module 8, respectively, in order to ensure a safe sealing action of the filter modules 8 relative to one another and in the case of thermal expansion of the filter modules.

Fig. 3 shows a detail of a plan view onto a drainage support body 17. Preferably, its contour is circular disc-shaped with radially extending projections 31, 32. The projections 31, 32 have different lengths with regard to their radial extension so that the spacing between the projections cannot surpass a critical size and the layers 9.1 and 9.2 are safely supported on the projections 31, 32, despite the differential pressure between the hollow space 24 and the outer side of the filter cells 9, without the material of the layers, in particular, the nonwoven filter cloth, dropping into the drainage grooves 35 formed between the projections 31, 32. Preferably, the drainage support bodies 17 have a descending slope away from the central opening 10 to their rim. This ensures that the filtrate can flow radially in the drainage grooves 35 to the exterior toward the container housing 3.

Fig. 4 shows a section of the drainage support body 17 along the line IV-IV in Fig. 3. The strip-shaped, axial projections 31, 32 extending in the radial direction of the drainage support body 17 are spaced apart and form drainage grooves 35 for the filtrate.

Fig. 5 shows a plan view onto a support ring 41. Its inner diameter D corresponds to that of the central opening 10. The support ring 41 is provided in this embodiment with spaced apart ribs 43. Fig. 6 shows an axial section of the support

ring 41; it is shown that the ribs 43 are arranged on both sides of the base body 42 of the support ring.

Fig. 7 shows a view in the direction of arrow VII of the support ring 41. The openings 44 in the support ring 41 through which the non-filtrate reaches the hollow space 24 of the filter cells, are formed by the spaced apart ribs 43.

Fig. 8 shows a cross-section of one half of a filter module 8 in the embodiment without module seal (reference numeral 19 in Fig. 2) which is secured on the container bottom 4 and the drainage cover plate 34. On the container bottom 4 projections 22 are provided which secure the lower layer 9.2 of the filter layer directly and seal it against the container interior. In the same way, the projections 22 on the drainage cover plate 34 provide a fixation and sealing action of the upper layer 9.1 of the filter layer. A seal at the aforementioned sealing surfaces is therefore not required. Clamps 47 are provided at several locations on the periphery of the filter module 8 and are snapped into place on support knobs 48 which are arranged axially on the drainage support body 17. The clamps 47 connect the upper and lower drainage support bodies 17 of the filter module 8, respectively, and thus secure it on its periphery. For the purpose of disposal of individual filter cells 9, the clamps 47 can be removed.

Fig. 9 shows a detail of two different pressing devices for the drainage cover plate 34. A pressing device 49 provided under the container cover 36 is supported by the tie rod illustrated in Fig. 1 on the container bottom and secures the filter cells 9 of the filter module between the drainage cover plate 34 and the container bottom.

The drainage cover plate 34 can secure the filter cells 9 of the filter modules by means of a pressing device, not illustrated, which is supported external to the

module filter on the container cover and acts with its press rod 50 on the drainage cover plate 34.

Claims

1. Module filter (1) comprising a container (2), comprised of at least one container housing (3) and a container bottom (4) and comprising at least one admission for a non-filtrate (6) and a discharge for the filtrate (7), comprising at least one filter module (8), comprised of several stacked, disc-shaped filter cells (9) substantially comprised of filter material (40) and having a central opening (10), respectively, and thus forming at least one central channel (28), which is, in turn, in fluid communication with the inner space (24) of each filter cell (9), and comprising support bodies between the filter cells (9), characterized in that the central channel (28) is connected to an admission (6') for the non-filtrate and connected with the inner space (24) of the filter cells (9) and in that a space (3') surrounding the filter cells (9) is formed within the container housing (3) which is connected with the discharge (7') for the filtrate, and in that the support bodies are formed as drainage support bodies (17) which extend at least approximately over the entire surface area of the filter cells (9), wherein in the drainage support body (17) a plurality of drainage channels (35) are provided which extend toward the outer rim of the filter cells or the drainage support bodies.
2. Module filter according to claim 1, characterized in that the drainage support bodies (17) are formed as a circular disc, wherein these projections (31, 32) project in the axial direction from the disc and extend in the radial direction, wherein the intermediate spaces between the projections (31, 32) are formed as drainage channels (35) and serve for removing the filtrate.
3. Module filter according to claim 1,

characterized in that the filter cells (9) and drainage support bodies (17) have a descending slope from the central channel (28) radially outwardly.

4. Module filter according to one of the claims 1 to 3,
characterized in that the drainage support bodies (17) and filter cells (9) are formed as circular disks and have at least substantially the same diameter.
5. Module filter according to claim 4,
characterized in that the drainage channels (35) extend as radial beams to the peripheral rim of the drainage support body (17).
6. Module filter according to one of the claims 1 to 5,
characterized in that, on the side of each filter cell (9) facing the central channel (28), the filter material (40) of each filter cell (9) is spaced apart by means of a support element (41), wherein the support element (41) is a support ring, which by means of a penetration (44) arranged therein provides a fluid communication from the central channel (28) to the inner space (24) of the filter cells (9).
7. Module filter according to one of the claims 1 to 6,
characterized in that the inner diameter (D) of the support ring (41) corresponds approximately to the diameter of the central opening (10).
8. Module filter according to claim 6 or 7,
characterized in that the support ring (41) is comprised of a flat annular base body (42), wherein the base body (42) has spaced apart axial projections (43) which extend radially strip-shaped on both sides of the base body (42).

9. Module filter according to one of the claims 1 to 8,
characterized in that each filter cell (9) is formed by an upper layer (9.1) and
a lower layer (9.2) of the filter material (40) and the radially outer rims (51)
of the upper and lower layers (9.1, 9.2) are connected by a frame (29) to one
another wherein preferably the filter material (40) is a nonwoven filter cloth.
10. Module filter according to claim 9,
characterized in that the frame (29) at its underside has support knobs (30)
and the frames (29) are supported on one another therewith.
11. Module filter according to one of the claims 1 to 10,
characterized in that the filter module (8) is comprised of several alternatingly
stacked filter cells (9) and drainage support bodies (17) and in that a closure
ring (11) is provided axially at the ends of the filter module (8), respectively,
and coaxially to the central opening (10).
12. Module filter according to claim 10,
characterized in that the filter cells (9) and drainage support bodies (17)
forming the filter module (8) are held together by an element (23) arranged
at the side facing the central channel (28) and receiving the tensile forces.
13. Module filter according to claim 12,
characterized in that the element (23) is a sleeve (23) comprised of metal,
which has at its mantle surface a plurality of openings (39), and in that the
sleeve (23) is connected with its end faces positive-lockingly with the closure
rings (11).
14. Module filter according to claim 13,

characterized in that in the closure ring (11) a recess in the form of an annular ring (26) is provided for receiving a sealing ring (19).

15. Module filter according to claim 1,
characterized in that in the central channel (28) a central rod (33) as a tie rod is provided and is supported by means of a fastening arrangement (15) on the container bottom (4) of the module filter (1) and in that the drainage cover plate (34) is arranged at the upper end of the central pipe (33).
16. Module filter according to one of the claims 1 to 14,
characterized in that the filter modules (8) are aligned with their central openings (10) axially above one another and are secured by means of a drainage cover plate (34) in the container (2).
17. Module filter according to claim 15 or 16,
characterized in that the drainage cover plate (34) is supported by a support cap (12) with support ribs (13) on the container cover (36).
18. Module filter according to claim 15 or 16,
characterized in that a press plate (14) provided with an axial tie rod is provided as a drainage cover plate (34).
19. Module filter according to one of the claims 1 to 18,
characterized in that between the container bottom (4) and the lowermost filter module (8) a drainage bottom plate (46) is arranged which has a recess (47) in an area neighboring the discharge (7').
20. Module filter according to claim 15 or 16,

characterized in that the drainage cover plate (34) secures the filter modules between the drainage bottom plate (46) either by means of a pressing device (49), which is supported external to the container (2) on the container cover (36), or by means of a pressing device (49), which is supported within the container (2) on the container bottom (4) by means of a central rod (33) and a fastening arrangement (15).

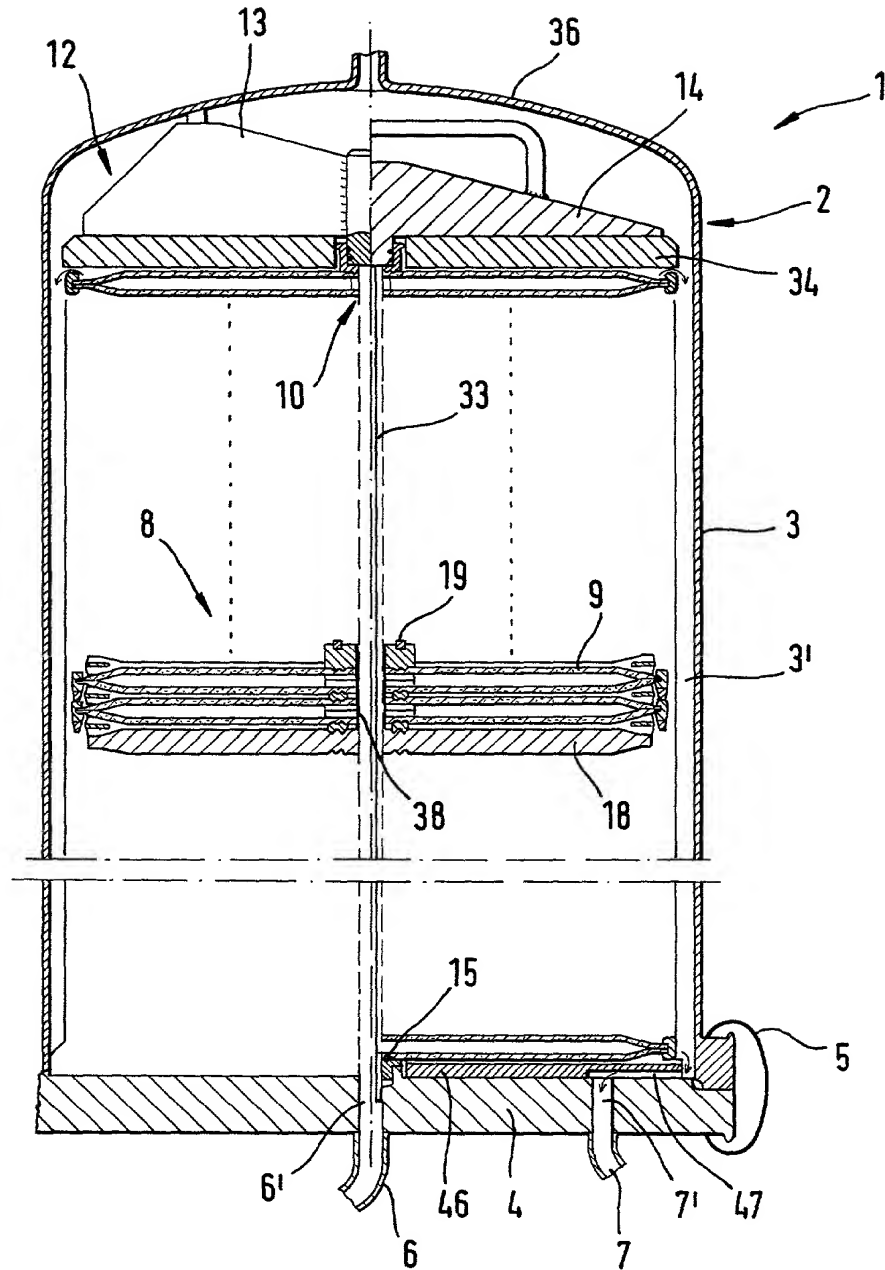
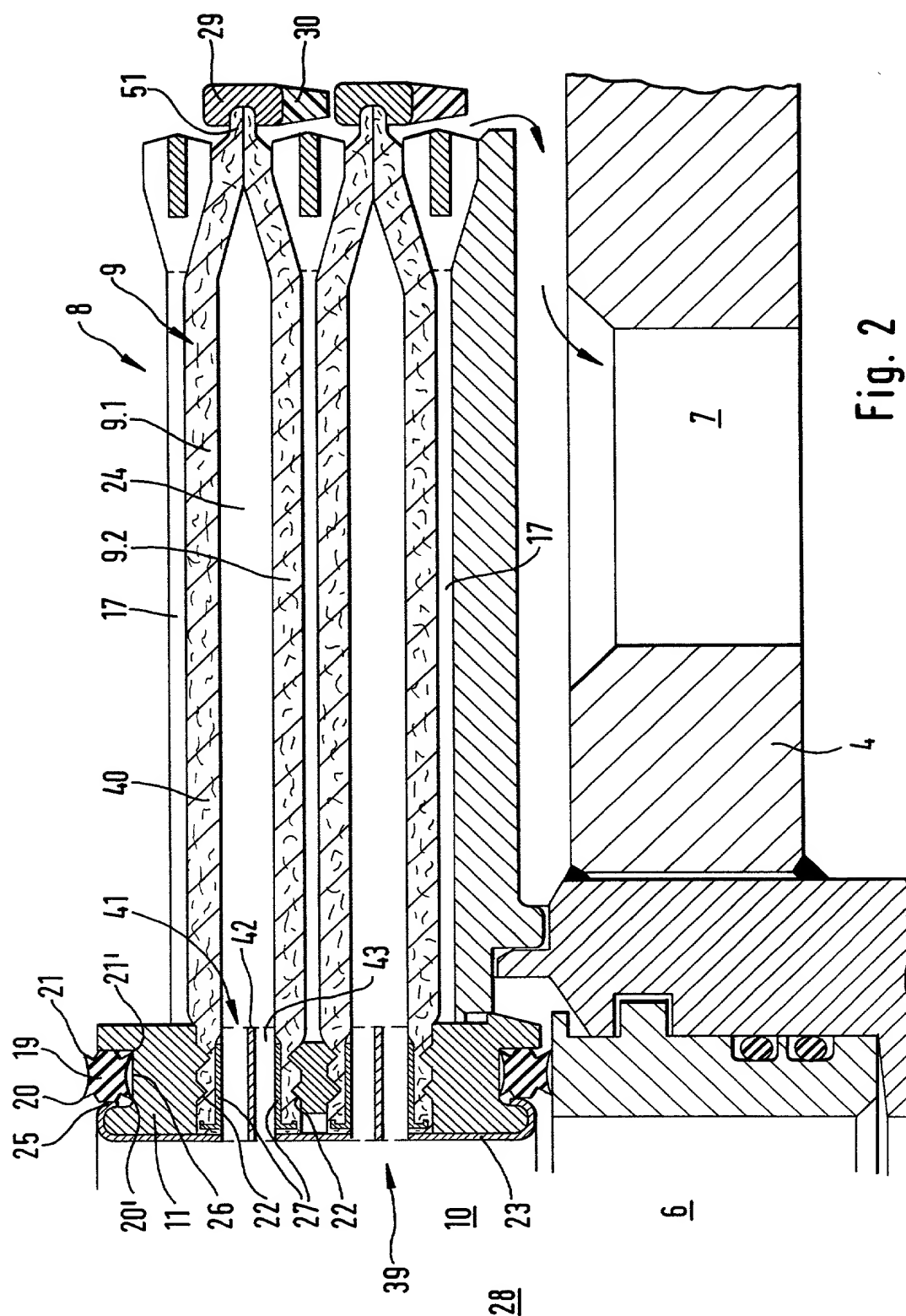


Fig. 1



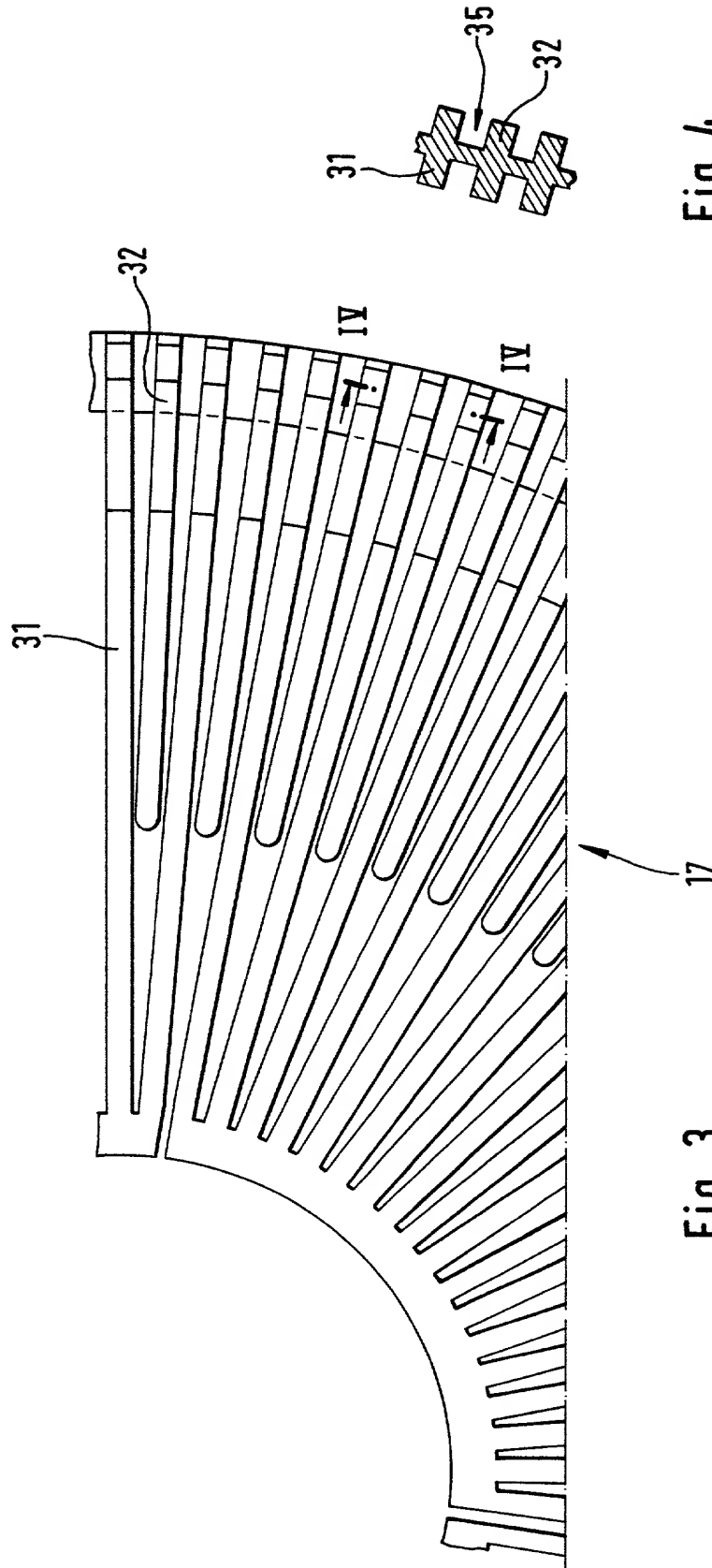


Fig. 4

Fig. 3

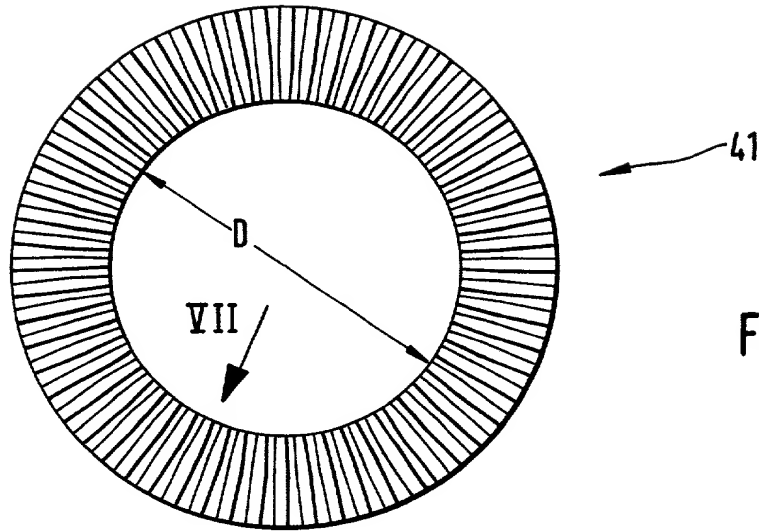


Fig. 5

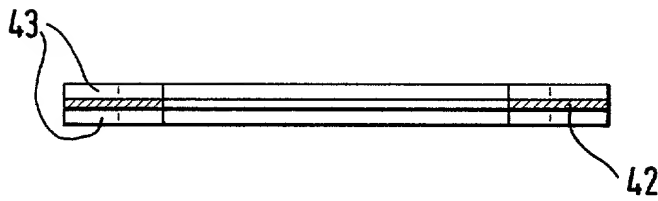


Fig. 6

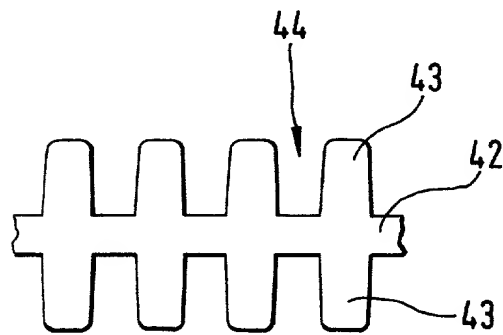


Fig. 7

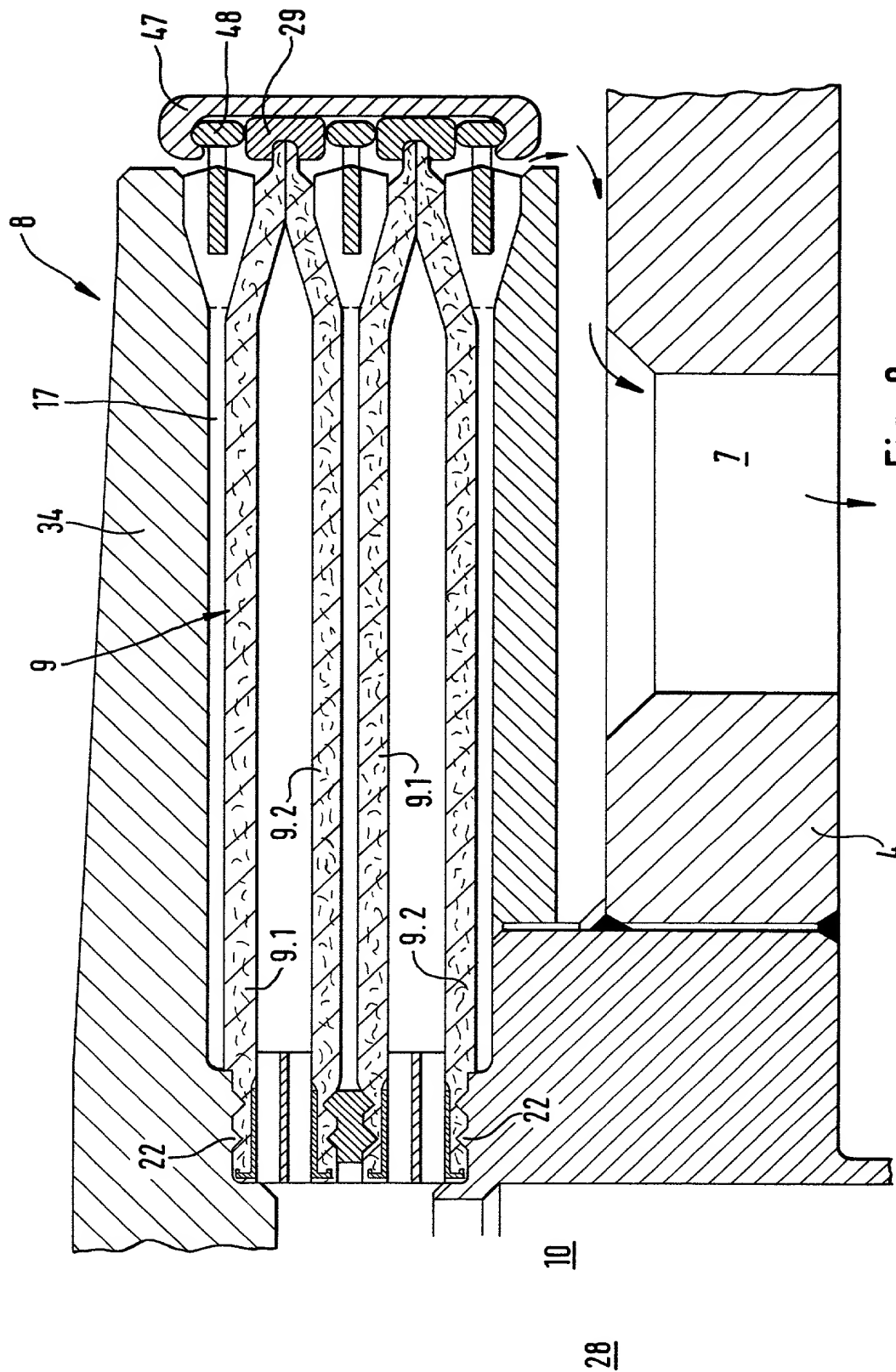


Fig. 8

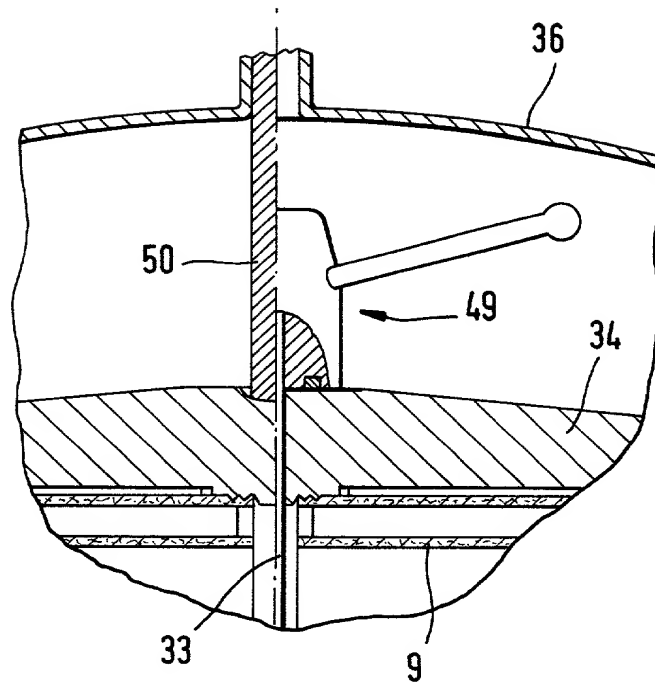


Fig. 9

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought of the invention entitled:

Module Filter Comprising at Least one Admission for the Non-Filtrate and at Least One Discharge for the Filtrate and Comprising at Least One Filter Module

the specification of which

☐ is attached hereto; or

☒ was filed on 08 Dec 1999 ✓ as
US Application Ser. No. _____ or PCT Application No. PCT/EP99/09634 ✓
and was amended on _____.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under Title 35 U.S.C. 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(b) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application Ser. No.	Country	Foreign Filing Date (Month/Day/Year)	Priority Claimed	
			Yes	No
198 57 751.6 ✓	Germany ✓	12/15/1998 ✓	X	

Attorney Docket No. _____

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

Application No.	Filing Date (Month/Day/Year)

I hereby claim the benefit under Title 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

U.S. Parent Application or PCT Parent No.	Parent Filing Date (Month/Day/Year)	Parent Patent No.

As a named inventor, I hereby appoint the following registered practitioner to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these

Attorney Docket No. _____

statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Inventor's signature _____ Date: _____
 Residence: _____
 Citizenship: _____
 Post Office Address: _____

_____ Additional inventors are being named on the supplemental Additional Inventor(s) sheet(s)